Arto V. 6.

A DESCRIPTION OF RIFLED ORDNANCE;

Fitted with Sectors, Telescopes, &c.

In which is contained, an Account of the Nature and Properties of RIFLES in general.

By JAMES LIND, M. D.

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M,DCC,LXXVI.

G R · III
BR. MUS.

TO THE

RIGHT HONOURABLE

JAMES STEWART MACKENZIE

OF

Roſehaugh, Lord Privy-Seal of Scotland, and one of his Majeſty's Moſt Honourable Privy-Council.

MY LORD,

I NEED make no Apology for dedicating to your Lordſhip this ſmall Performance, relating to RIFLED ORDNANCE, furniſhed with Sectors and Teleſcopes; ſince no Perſon is more capable than your Lordſhip, both of underſtanding and improving ſuch Contrivances; and, ſince the Gun I have deſcribed is not altogether confined to Military purpoſes, but is principally calculated for experiments with regard to the Reſiſtance of the Air, the moſt difficult Branch of mixed Mathematicks, I hope your Lordſhip will accept of this Dedication as a Teſtimony of my grateful Senſe of the Favours with which you have honoured me. I am, with the greateſt Reſpect,

My Lord,

Your Lordſhip's

Much obliged,

And moſt devoted

Humble Servant,

JAMES LIND.

ERRATA.

Page 9. line 2. dele *the.*

Page 9. line 8. *for* $\frac{15}{16}$ *read* $\frac{135}{16}$.

Deſcription of a Caſt Iron Rifled Cannon, fitted with a Sector, Teleſcope, &c.

THIS ſpecies of ordnance, and its apparatus, was the united contrivance of Captain Alexander Blair (late of the 69th regiment of foot, an accompliſhed ſoldier, and an ingenious man) and myſelf, in the beginning of ſummer 1774, I being at that time engaged in making ſome experiments on caſt-iron, at the great and noble iron foundry at Carron.

Guns of this conſtruction, which are intended for the field, ought never to be made to carry a ball of above one or two pounds weight at moſt; a leaden bullet of that weight being ſufficient to deſtroy either man or horſe.

A pound gun, of this conſtruction, of good metal, *ſuch as is now made by the Car-*

ron company *, need not weigh above an hundred pounds weight, and its carriage about another hundred. It can, therefore, be eaſily tranſported from place to place, by a few men; and a couple of good horſes may tranſport ſix of theſe guns, and their carriages, if put into a cart.

But, for making experiments, in order to determine the reſiſtance which bodies moving with great velocities meet with from the air †, a circumſtance to which theſe guns are particularly well adapted, or, for annoying an enemy's Sappers that are carrying on their approaches towards a beſieged place, a larger caliber may be uſed.

Length,

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* See the proofs at the end.

† The ſolution of this moſt difficult problem the world may expect ſoon to be favoured with, from that excellent mathematician Mr Glenie, author of the Hiſtory of Gunnery, who has nearly completed the Mathematical part of it, and only waits for a few accurate experiments in order to finiſh the whole.

Length, and general Rules for Caſt-Iron Rifled Guns.

The length of the gun being divided into ſeven equal parts, the length of the firſt reinforce AB is two of theſe parts; the ſecond BC one and $\frac{15}{16}$ of the diameter of the caliber; the chaſe CD four wanting $\frac{15}{16}$ of the diameter of the caliber.

The diſtance from the hind part of the baſe-ring A, to the beginning of the bore, is one caliber and $\frac{3}{16}$ of a caliber. The trunnions TT are each a caliber in breadth, and the ſame in length; their centers are placed three-ſevenths of the gun's length from the hind part of the baſe-ring, in ſuch a manner, that the axis of the trunnions paſſes through the center line of the bore, which prevents the gun from kicking, and breaking its carriage *. The length of the caſcable is one caliber and $\frac{13}{16}$ of a caliber.

Muller's Artillery, p. 41.

General

General Dimenſions of Caſt-iron Rifled Guns.

The caliber of the gun being divided into 16 equal parts;

The thickneſs of metal at the baſe-ring A from the bore, is -	18,5
At the end of the firſt reinforce ring B. - -	17
At the ſame place, for the beginning of the ſecond reinforce -	17
At the end of the ſecond reinforce C. - - -	15
At the ſame place, for the beginning of the chaſe c.	13,75
At the end of the chaſe or muzzle, the mouldings a D excluded	9
At the ſwelling of the muzzle b.	12
At the muzzle-fillet c.	9,5
At the extreme moulding D.	8

Breadth of Mouldings.

Baſe-ring - -	5,5
Ogee next the baſe-ring d.	4,5

The

The aſtragal or half-round	1,75
Its fillet	1
Total aſtragal and fillets at the vent-field e.	4
Firſt reinforce ring B.	4,5
Second reinforce ring C.	3,5
Its ogee	3
Its aſtragal	1,5
And its fillet	1
The muzzle aſtragal, and fillet a.	4

Caſcable.

Breadth of the fillet at the baſe-ring	1
Diſtance of the fillet at the button from the fillet at the baſe-ring	5
Breadth of the fillet at the button	1
Diameter of the fillet at the button	18
Diſtance of the center of the button from its fillet	12
Diameter of the button E.	18
Diameter of its neck	10,5

Vent.

Vent.

The vent ſhould be placed about half an inch from the bottom of the chamber or bore, that the cartridge may be pricked, although ſome of the bottoms of the cartridges ſhould be left in when the gun is ſponged, a circumſtance which might retard the firing till the ſhot be again drawn, (which is no eaſy matter), and the gun be cleaned out. From ſome experiments of Colonel Deſaguliers and Mr Muller, it is imagined, that the powder never has ſo ſtrong an effect as when it is fired cloſe to the bottom of the bore; yet it is found, by the experiments of Count De la Lippe, to have the greateſt effect when fired near to the middle of the charge. This he proved by firing it with tubes introduced at a vent, bored through the button and breech of the gun, of different lengths, ſo as to reach the different parts of the powder. In the ſame manner, a muſket or fowling-piece is found to puſh more when the touch-hole is placed at ſome little diſtance from the bottom of the bore, which ariſes from nothing but the powder's acting with more force *, by being inflamed to greater advantage; conſequently, in this caſe, the ſame quantity of powder will have a greater effect, than when the touch-hole is placed at the bottom of the bore, which may be of ſome uſe in huſbanding the powder.

The above dimenſions are taken from ſome elegant ½ pound guns, which were made for the Prince of Auſturias by the Carron company. But, I think, they would exceed, not only in appearance, but likewiſe in ſtrength, (the goodneſs and thickneſs of the metal being the ſame), thoſe made with reinforces of three fruſtums of cones joined together, if conſtructed ſomewhat in the ſame manner as thoſe recommended by Mr Muller, in his Treatiſe of Artillery; or, if caſt fruſtums of ſingle cones, with a few light

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* Newton, Princip. Lex. III. p. 14.

light and elegant mouldings upon them, which cannot conſiderably hinder the vibrations excited in them when fired, from being propagated in an uniform and uninterrupted manner from one end to the other; a circumſtance which cannot happen where the different thickneſſes of the metal are made in ſteps, as is the general cuſtom over all Europe; for, where the progreſs of the vibrations is ſuddenly changed, a diſcord or jarring takes place, which gives the parts a greater tendency to ſeparate there than at any other place, and thereby occaſions the burſting of the gun, when it would not otherwiſe happen.

Rifles.

The rifles make one ſpiral turn in the length of the bore, but go no nearer to the breech, in their full ſize, than two calibers, and then terminate with a gentle ſlope in half a caliber more, ſo as not to prevent the cartridge with the powder from being eaſily ſent home to the bottom of the gun, which would otherwiſe conſtantly happen with the flannel cartridges, and even ſometimes with paper ones, if not made to enter very looſely. The ſhape of the rifles is ſemicircular, their breadth being equal to the diameter, which is $\frac{3}{10}$ of a caliber, and their depth equal to the ſemidiameter, or $\frac{15}{10}$ of a caliber.

The rifles are formed in the gun by having them moulded on the core upon which the gun is caſt.

Bore.

The bore is afterwards finiſhed of its intended ſize, with borers, Fig. 2d, made of the form of a ſhort fruſtum of a cone, and cut on the outſide like a coarſe file; it being impoſſible to finiſh the bore in the common manner, with cutters, without deſtroying the rifles.

The inſtrument uſed for cleaning out and finiſhing the rifles, is an iron ſocket, Fig. 3d, a, with two branches, b c, made of ſteel, which ſpring outwards with conſiderable force, having ſhort files, d e, of the breadth and depth of the rifles fixed on the ends of the branches. In the ſocket is fixed a wooden rod, A B, of about four feet long, and an inch in diameter, with a croſs handle, D, upon the other end of it, moveable, ſo as to allow the rod and ſpring-files to turn round, and follow the ſpiral turns of the rifles, as the inſtrument is worked up and down in the gun. Care ſhould be taken that every part of the rifles be made of the ſame ſize, and that the ſpirals be parallel to each other.

Bullets.

The bullets, Fig. 4th, are of lead, having ſix knobs caſt on them to fit the rifles of the gun. They are caſt in the mould figure, Fig. 5th. Being thus made of ſoft metal, they do not injure the rifles, and may alſo ſave an army the trouble of carrying a great quantity of ſhot about with them, ſince a ſupply of lead may be had in moſt countries from roofs, &c. which can be caſt into balls as occaſion requires. Lead likewiſe being of greater ſpecific gravity than caſt-iron, flies to a much greater diſtance.

Rifled ordnance of any caliber might be made to carry iron ſhot, for battering or for other purpoſes, provided holes that are a little wider at their bottoms than at their upper parts, be caſt in a zone round the ball for receiving afterwards leaden knobs to fit the rifles of the cannon; by which means, the iron ſhot will have its intended line of direction preſerved, without injuring the rifles more than if the whole ball was of lead, the rotatory motion round its axis, in the line of its direction, (which corrects the aberration,) being communicated to it by the leaden knobs, following the ſpiral turn of the rifles in its progreſs out of the gun. It is particularly to be obſerved, that the balls muſt be made to go eaſily down into the piece, ſo that the cartridge with the powder and the bullet may be both ſent home together, with a ſingle puſh of the hand, without any wadding above eithe powder or ball, by which means, the gun is quickly loaded, and the ball flies farther than when it is forcibly driven into the gun, as was found from many experiments. The only reaſon why, in common rifled muſkets, the bullets are rammed in forcibly, is this, that the zone of the ball which is contiguous to the inſide of the bore may have the figure of the rifles impreſſed upon it, in ſuch a manner as to become part of a male ſcrew, exactly fitting the indents of the rifle, which is not at all neceſſary in our caſe, the figure of the rifles being originally caſt upon the ball. Theſe knobs retard the flight of the bullet in ſome degree; but this ſmall diſadvantage is fully made up by the eaſe with which the gun is loaded, its ſervice being nearly as quick as that of a common fieldpiece; and the retardation and quantity of the whirling motion, which is communicated to the bullet being conſtantly the ſame, it will not in the leaſt affect the experiments made with them, in order to determine the reſiſtance of the air.

Deſcription and dimenſions of the Sector belonging to Rifled Guns.

The principal parts are.

1ſt, The Limb, which is divided ſo as to ſhew elevations to 15 or 20 degrees. The length of the radius is five inches and an half, and its nonius is ſo divided as to ſhew minutes of a degree.

2d, The teleſcope, AB, Fig. 8. an achromatic refractor, is 7 inches in length, (ſuch as is uſed on Hadely's Quadrants, that are fitted for taking diſtances of the moon from the ſun or ſtars, in order to obtain the longitude at ſea) having croſs hairs in it.

3d, The parallel cylindric bar, CD, is $\frac{4}{10}$ of an inch in diameter, having two rectangular ends EF each half an inch ſquare, and an inch long. On one ſide of the end, next the limb of the ſector, is a mark correſponding to a ſimilar one on the hinder cock of the gun *, with which it muſt always coincide, when placed on the gun. The length of the parallel bar, together with its ends, is 7 inches. This bar is fixed to the ſector by means of two hollow cylinders, GH, which allow the ſector a motion round the bar. There is a finger-ſcrew, a, upon the hollow cylinder, G, which is ſlit, in order to tighten it at pleaſure upon the bar.

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* Vid. deſcript. of the Cocks. p. 16.

4th, The circular level I, Fig. 8. and 9. for ſetting the plain of the ſector always perpendicular when placed upon the gun, is $\frac{3}{4}$ of an inch in diameter. There is a ſmall ſcrew, d, to adjuſt the level at right angles to the plain of the ſector.

5th, A finger ſcrew, b, for fixing the index of the ſector at any particular degree of elevation propoſed.

Of adjuſting the Line of Collimation.

The line of collimation (that is, the line of viſion cut by the interſecting point of the two croſs-hairs in the teleſcope,) muſt be adjuſted truly parallel to the bar of the ſector when at 0 degrees. This is done by placing the ſector ſo that the vertical hair may exactly cover ſome very diſtant perpendicular line. If it again covers it when the ſector is inverted, by turning it half round upon the bar, which has all the while been kept ſteady and firm, that hair is correct, if not, correct half the error by means of the ſmall ſcrews, c d e, Fig. 8. and 10. at the eye-end of the teleſcope, and the other half, by moving the bar; place it again to cover the perpendicular line, and repeat the above operation, till the hair covers it in both poſitions of the ſector. Then turn the ſector, till the horizontal hair cover the ſame perpendicular line, and turning the ſector half round on its bar, correct it, if wrong, in the ſame manner as you did the vertical hair.

N. B. Of the four ſmall ſcrews at the eye end of the teleſcope, theſe at the right and left hand move whatever hair is vertical, and theſe at top or underneath, move whatever hair is horizontal.

Cocks.

On the ſide of the gun upon the firſt reinforce, are caſt two knobs, F, Fig. 1. and 6. having their middle part diſtant from each other 6 inches, for fixing on the braſs cocks A, Fig. 6. and 7. which receive the rectangular ends of the parallel cylindric bar of the ſector, when placed on the gun.

Adjuſtment of the Paraliel Bar and Line of Collimation with the Bore of the Gun.

The next adjuſtment is to make the parallel bar, and line of collimation of the teleſcope, when ſet at o degrees, parallel to the bore of the gun, and conſequently to the direction of the ſhot. The gun being loaded, the cartridge pricked, and the gun primed, place the ſector in the cocks of the gun, and having firſt ſet the ſector to what elevation you judge neceſſary, bring the interſection of the croſs-hairs in the teleſcope, upon the center of the mark A, Fig. 11. the limb

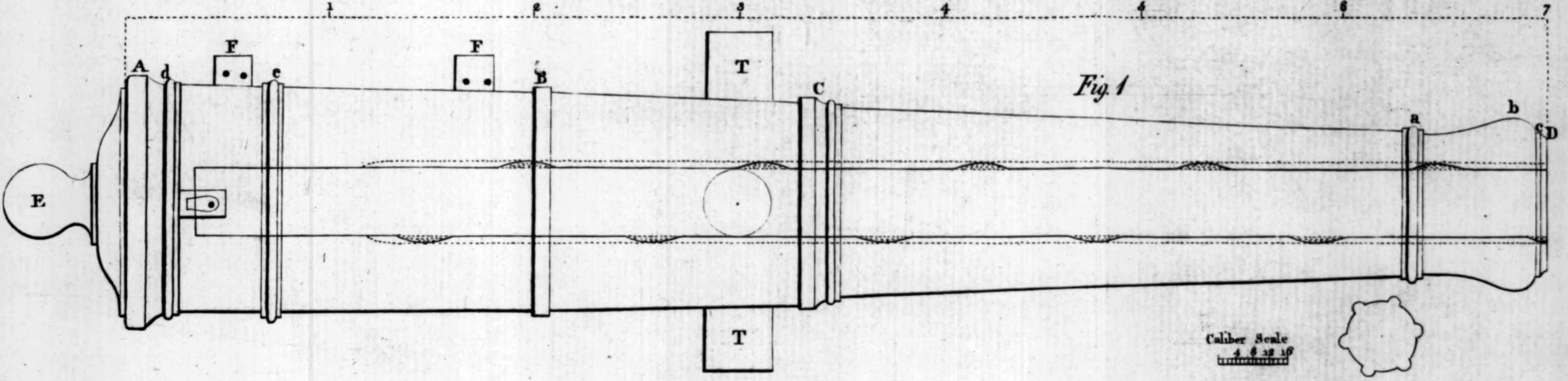


Fig. 1

Fig. 7

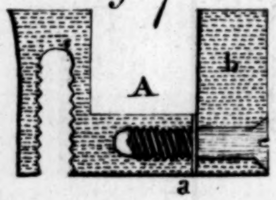


Fig. 2

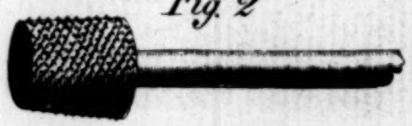


Fig. 3

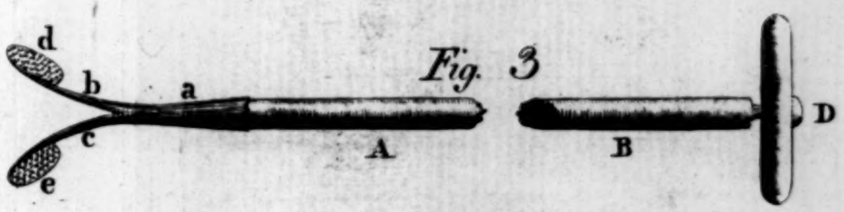


Fig. 6

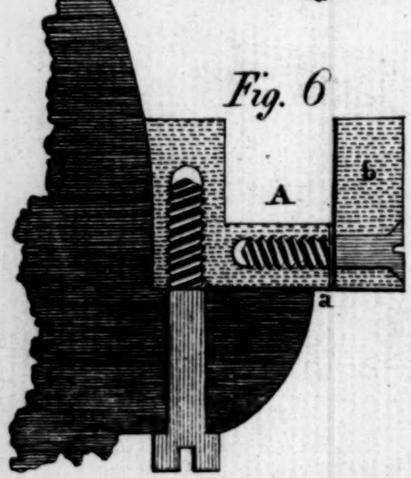


Fig. 5

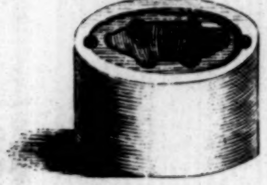


Fig. 5

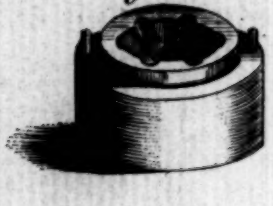


Fig. 4

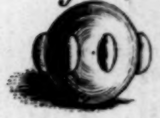
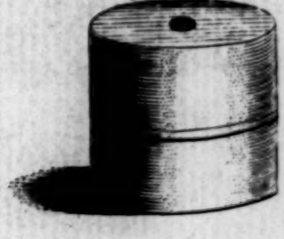


Fig. 5



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J: Ainslie Sculp!

limb of the ſector being ſet vertical by means of the circular level, and then take off the ſector, without moving the gun. Fire the gun, and, if the bullet hits any where in the perpendicular line, a b, paſſing through the center of the mark, A, the line of collimation of the teleſcope and direction of the ſhot agree. But, if it hit to the right of the mark, at a point, B, ſo much do they differ. In order to correct which, bring the gun into the ſame poſition it was in before firing, and ſecure it there. Then file away as much of the fore-cock, on the ſide next the gun, as will let the interſection of the croſs-hair fall ſome where on the line, c d, paſſing perpendicularly through the point B, where the ſhot fell; and it is then adjuſted in that poſition, ſo much being filed off the ſide of the cock at a, Fig. 6. and 7. as will allow the ſide b, to be ſcrewed cloſer, that the ends of the parallel bar may have no ſhake in the cocks. To correct it in the other poſition, and ſo to find the true o degrees of the gun, that is, to bring the line of collimation of the teleſcope, parallel-bar, and bore of the gun, truly parallel to each other, repeat the above with the trunions perpendicular to the horizon, the ſector being turned a quarter round upon its bar, ſo as to bring its plane vertical. The deviation of the ſhot found in this way is corrected by deepening one of the cocks, ſo that the vertical hair of the teleſcope may be brought to cover the line paſſing perpendicularly through the point where the bullet hits; the gun being placed in the ſame poſition it was in before it was fired. This adjuſtment being repeated two or three times, and any error that remains being corrected, the gun is fit to be mounted on its carriage for ſervice. It is to be obſerved, that this ſector will fit any gun, if the cocks and rectangular ends, &c. of the parallel bar be of the above dimenſions, and will be equally applicable to all ſuch pieces whoſe cocks have been adjuſted, as if it had been adjuſted ſeparately with each of them. And if the

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Plate. 2

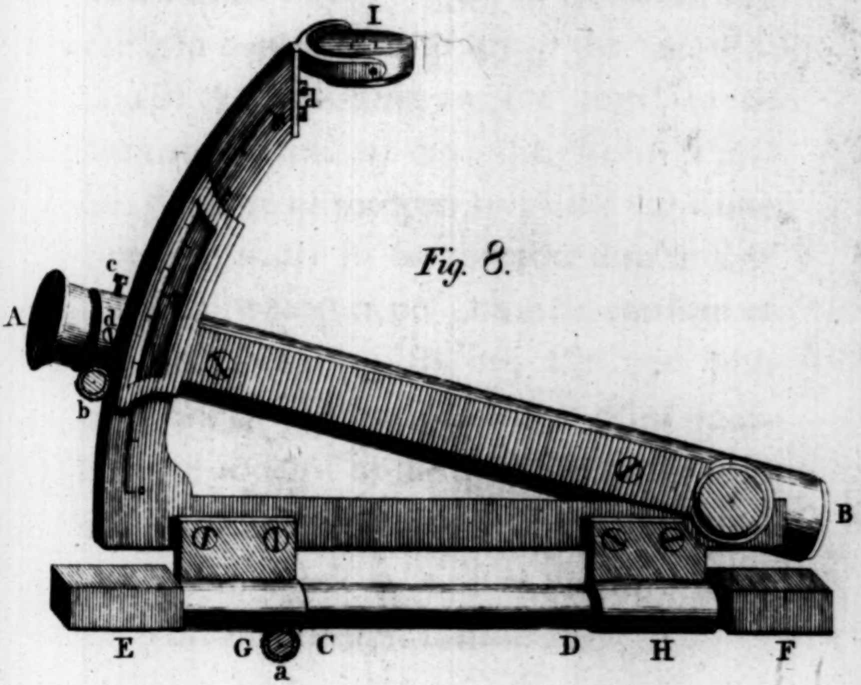


Fig. 8.

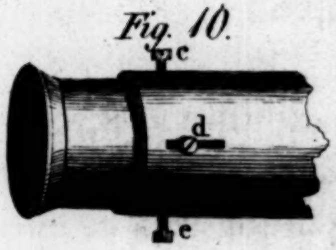


Fig. 10.

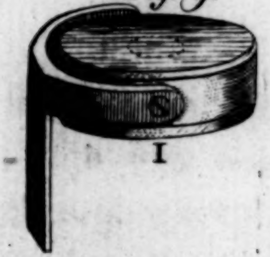


Fig. 9.

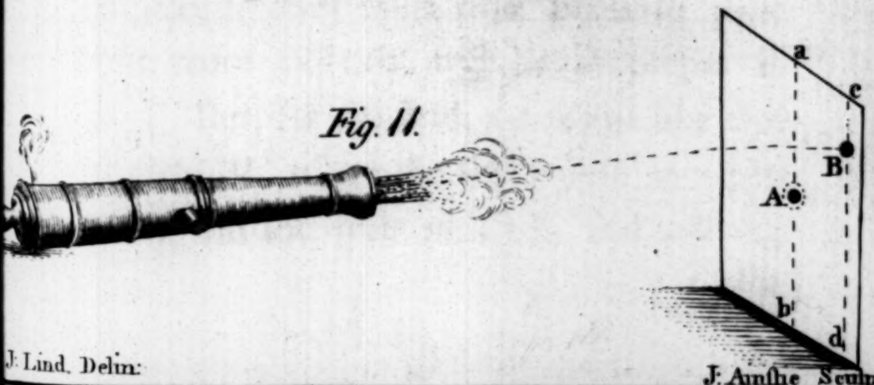


Fig. 11.

J. Lind. Delin:

J: Ainſlie Sculp^{t}

ſector be ſet at any degree of elevation, and the gun moved ſo as to bring the interſection of the croſs-hairs on the object to be fired at (the limb of the ſector being vertical) the bore of the gun will have the ſame elevation above it, in the true direction of the ſhot, whatever poſition the carriage of the gun is ſtanding in. A teleſcope with croſs-hairs, fixed to a common rifled muſket, and adjuſted to the direction of the ſhot, will make any perſon, with a very little practice, hit an object with more preciſion than the moſt experienced markſman.

Carriage.

For garriſon ſervice, or for batteries, the ſhip or garriſon carriage, with two iron ſtaples on each ſide to put through a couple of poles to carry them from place to place with more diſpatch, will be as proper as any. But, for the field, a carriage like that at plate III. where the ſhafts puſh in upon taking out the iron pins a b, and moving the croſs bar A, upon which the breech of the gun reſts, as far down as the ſhafts were puſhed in, is the propereſt, ſince the whole can then be carried like a hand-barrow, over ditches, walls, or rough ground, all which may be eaſily underſtood from the annexed figure.

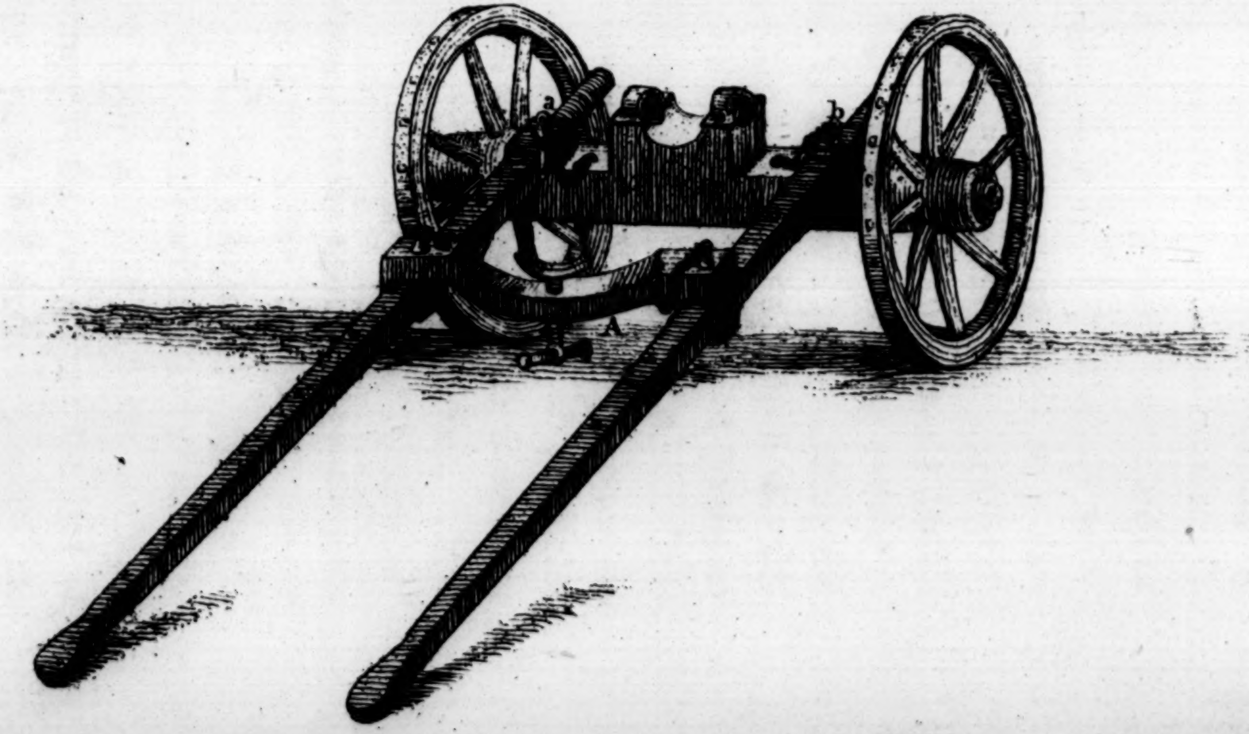
The principal advantage that will accrue from the uſe of rifled ordance, is the great certainty with which any object may be hit when fired at with them, ſince the ſhot deviates but little from its intended line of direction, and the gun is capable of being brought to bear upon the object, with great exactneſs, by means of the teleſcope and croſs-hairs.

Manner in which the Abberration of the Shot is prevented.

The way in which the aberrations of a projectile is prevented, by being made to whirl round an axis, in the line of the direction of the flight, may be eaſily under-

ſtood,

P. 20 *Plate 3.*



J: Lind, Delin:

ſtood, from conſidering the ſlow motion of an arrow through the air. For example, if a bent arrow, with its wings not placed in ſome degree in a ſpiral poſition, ſo as to make it revolve round its axis, as it flies through the air, were ſhot at a mark with a true direction, it would conſtantly deviate from it, in conſequence of being preſſed to one ſide, by the convex part oppoſing the air obliquely. And, let us ſuppoſe this deflection in a flight of an hundred yards, to be equal to ten yards ; now, if the ſame bent arrow were made to revolve round its axis once in every two yards of its flight, its greateſt deviation would take place when it had proceeded one yard, or made half a revolution ; ſince, at the end of the next half revolution, it would again return to the ſame direction it had at firſt, the convex ſide of the arrow having been once in oppoſie poſitions. In this manner it would proceed during the whole courſe of its flight, conſtantly returning to the true path at the end of every two yards, and when it reached the mark, the greateſt deflection to either ſide that could happen, would be equal to what it makes in proceeding one yard, equal to one hundredth part of the former, or three inches ſix-tenths of an inch, a very ſmall deflection when compared with the preceding one. In the ſame manner, a cannon ball, which turns not round its axis in the line of direction of the ſhot, deviates greatly from the true path, on account of inequalities on its ſurface, which although ſmall, cauſe great deviations, by reaſon of the vaſt reſiſtance that bodies flying with ſwift motions meet with from the air, that of a 12 pound ſhot moving with a velocity of 1700 feet per ſecond, according to the celebrated Mr Robins, being equal to 433 pounds weight. And this may be eaſily conceived from ſeeing the irregular motions of an oyſter-ſhell ſkimming through the air, as it preſents different ſides to the reſiſting medium.

Another cauſe of deviation which is corrected by the ball's revolving round its axis, in the direction of its flight, is the effect of a whirling motion, which the ball acquires in ſome other direction, by rubbing againſt the ſides of the piece, aud thereby ſtrikes the air in a different manner from what it would do, had it only a progreſſive motion. And this oblique reſiſtance of the air cauſes it to deviate greatly from its original courſe*. From this circumſtance, joined to inequalities on the ſurfaces of the bullets, Mr Robins found a ball of ¾ of an inch diameter, although fired with a true direction to the diſtance of 760 yards, deviate ſometimes 100 yards to the right, and at other times as much to the left. He likewiſe found, that its direction in the perpendicular line was no leſs uncertain, ſince it fell at one time 200 yards ſhort of the diſtance it flew to at another †; whereas the greateſt lateral deviation, or deflection, of a rifled field-piece, fired to a diſtance of 1500 feet, did not exceed, when greateſt, a foot and a half, or two feet, and none of the bullets ever ſhifted its face, during their flight, ſince the ſide that was next the powder, which had numbers on them, were all intire, the oppoſite ones being conſiderably bruiſed and deformed; nor did the whirling motion in the direction of the flight, communicated to it by the rifles, ſeem to be much diminiſhed, for the bruiſed face was very much twiſted in entering the ground.

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* Robin's New Principles of Gunnery, p. 257.

† Ibid, p. 150.

But, from what has been obſerved above, it is evident, that all theſe irregularities and deflections are intirely removed, by means of the rifles; and that the only variations in the ranges ariſe from the inequalities of the powder, and the different ſtates of the atmoſphere, the elevations being the ſame.

PROOFS

OF

ORDNANCE

Caſt by the CARRON COMPANY in SCOTLAND.

PROOF I.

TWenty-four Carron Guns made for Spain, viz. ſix 24, ſix 18, ſix 12, two 8, two 6, and two 4 pounders, which had ſtood the Spaniſh proof, ſuſtained each at Ferrol, in June 1774, ſixty rounds, fired on carriages, at intervals of two minutes, with the common ſervice-charge, in the following manner.

1. 12 Rounds, Horizontal.
   2 with bar ſhot do
2. 12 Rounds elevated 3 Degrees
   2 with bar ſhot do
3. 13 Rounds elevated 6 Degrees
   3 with bar ſhot do
4. 13 Rounds elevated 8 Degrees
   3 with bar ſhot do

The large calibers, after the fortieth round, became very much heated, and were refreſhed with tallow, till the end of the firing, at which time they became ſo hot, that a man could not hold his hand upon them. The guns all ſtood, and were accepted, as fit for ſervice.

The Spaniſh proof for iron ordnance is the ſtrongeſt in Europe, and the guns of the ſmalleſt dimenſions. The guns are placed with their breeches againſt a parapet, made in a ſloping ditch of earth, and ſtrongly fortified with plank and piling, on purpoſe to prevent recoil, and ſtaked down at the trunnions, to prevent reaction, with their muzzles elevated 22½ degrees. Each caliber is fired three times, the large ones, namely, 24 and 18 pounders, firſt with a charge of powder the weight of the ball, the ſecond three fourths, and the third with two thirds of its weight, and a ſingle ball each time. Thoſe of ſmaller calibers, are fired three times, with a charge of powder the weight of the ball, and a ſingle ſhot each time.

The Carron guns ſent to Spain have undergone the ſevereſt trials, particularly at Algiers, where the St Joſepha, a ſeventy-four gun ſhip, was ſent in to ſilence a battery, and, by her rigging being diſabled, ſhe could not for a long time be got off again, in which ſituation ſhe kept up an uninterrupted fire for 12 hours, and diſcharged every gun at leaſt 80 times; ſhe was mounted with Carron guns, all of which appeared as good after the engagement as before it.

PROOF II.

Proof made at Woolwich, by order of the Honourable Board of Ordnance, under the inſpection of General Williamſon, of ſix Carron guns, viz. two 24, two 18, and two 12 pounders.

Firſt the Ordnance Proof, and then,

2.	Two 24 *pr.*	15	rounds,	12 ℔	powder, and	1 ball.
	Two 18	15	do	9	do with	do
	Two 12	15	do	6	do with	do

At intervals of five minutes.

3.	Two 24 *pr.*	15	rounds,	11 ℔	powder, and	1 ball.
	Two 18	15	do	8	do with	do
	Two 12	15	do	5	do with	do

At intervals of ſix minutes.

4.	Two 24 *pr.*	15	rounds,	10 ℔	powder, and	1 ball.
	Two 18	15	do	7	do with	do
	Two 12	15	do	4	do with	do

At intervals of ſeven minutes.

All on Carriages: Then,

5.	Two 24 *pr.*	1	round,	12 ℔	powder, and	5 balls.
	Two 18	1	do	9	do with	do
	Two 12	1	do	6	do with	do

The following full to the Muzzle.

6.	Two 24 *pr.*	1	round,	12 ℔	powder, and	11 balls.
	Two 18	1	do	9	do with	do
	Two 12	1	do	6	do with	do

Stood all, ſearched ſound, and every way fit for ſervice.

PROOF III.

PROOF III.

Proof of three Carron guns, viz. two 12, and one 18 pounder, proved by the proof-maſter at Carron, in preſence of ſeveral gentlemen, and certified before Sir Michael Bruce, Bart. one of his Majeſty's Juſtices of Peace for the ſhire of Stirling.

1.	Two 12 *pr.*	2 rounds,	12 ℔	powder, and	1 ball.
	One 18	2 do	16	do with	do
2.	Two 12 *pr.*	2 rounds,	6 ℔	powder, and	2 balls.
	One 18	2 do	9	do with	do
3.	Two 12 *pr.*	1 round,	6 ℔	powder, and	5 balls.
	One 18	1 do	9	do with	do

The following full to the Muzzle.

4.	Two 12 *pr.*	1 round,	6 ℔	powder, and	11 balls.
	One 18	1 do	9	do with	do
5.	Two 12 *pr.*	1 round,	12 ℔	powder, and	9 balls.
	One 18	1 do	16	do with	do
6.	Two 12 *pr.*	7 rounds,	6 ℔	powder, and	11 balls.
	One 18	7 do	9	do with	do
7.	Two 12 *pr.*	2 rounds,	12 ℔	powder, and	9 balls.
	One 18	2 do	16	do with	do

Then one of the 12 pounders was bored up to the caliber of an 18 pounder, and the

18 pounder to that of a 24 pounder; the three guns then ſuſtained the following proof, in preſence of Sir Michael Bruce, Bart. Alexander Fraſer, Eſq; of Strichen, and myſelf, viz.

8.	The 12 *pr.*	1 round,	6 ℔	powder, and 11 balls.
	Bored up do	1 do	9	do with 5 18 *pr.* do
	do 18 *pr.*	1 do	12	do with 5 24 *pr.* do

The following all full to the Muzzle.

9.	The 12 *pr.*	2 rounds,	6 ℔	powder, and 11 balls.
	Bored up do	2 do	9	do with 9 18 *pr.* do
	do 18 *pr.*	2 do	12	do with 10 24 *pr.* do

A junk wadding was put in above every ball; the guns all ſound, and ring as well as at firſt. The gentlemen at Carron afterwards made the 12 pounder, which was bored up to an 18 pounder, undergo a further proof of eight rounds to the muzzle each time, with nine pound of powder, and nine 18 pounder balls, and it continues ſtill as ſound as at the beginning. The bored up guns recoiled 27 feet, plowing up the ground all the way behind them. This proof was finiſhed the 18th of April 1776.

	T.	C.	qr.	℔.
The bored up 12 pounder is 7½ long, and weighed before it was bored up	1	9	1	0
When bored up to an 18 pounder, it weighed	1	8	1	0
Lighter than when it ſtood the firſt 16 rounds, as a 12 pounder,	0	1	0	0
The bored up 18 pounder is 9 feet long, and weighed before it was bored up	2	0	0	0
When bored up to a 24 pounder, it weighed	1	16	1	4
Lighter than when it ſtood the firſt 16 rounds, as an 18 pounder,	0	3	2	24
An 18 pounder of 9 feet, Government ordnance pattern, weighs	2	0	0	0
The 18 pounder bored up from a 12 pounder of 7½ feet long, Government ordnance pattern, weighs	1	8	1	0
Lighter than a Government ordnance 18 pounder	0	11	3	0
The 24 pounder of 9½ feet long, Government ordnance pattern, weighs	2	9	0	0
The 24 pounder bored up from an 18 pounder of 9 feet, Government ordnance pattern, weighs	1	16	1	4
Lighter than a Government ordnance 24 pounder	0	12	2	24

FINIS.

[illegible]